REMARKS

Claims 10-14, 17, 18 and 20 are pending in the present application. Claim 14 has been amended. Claim 15 has been canceled. (In the previous Amendment dated July 26, 2004, claims 1-9 were indicated in the Listing of Claims section as **canceled**.)

Claim Rejections-35 U.S.C. 103

Claims 10-15, 17, 18 and 20 have been rejected under 35 U.S.C. 103(a) as being unpatentable over the Wang reference (U.S. Patent No. 5,604,155) in view of Japanese Patent Publication No. 9-249966 (referred to as the Soichi reference in the Office Actions). This rejection is respectfully traversed for the following reasons.

The method of depositing a wiring thin film over a semiconductor substrate of claim 10 includes in combination "...sputter depositing an Al_3Ti layer on said Ti layer using said Al_3Ti target"; and "after the sputter depositing, annealing said substrate at a temperature of at least 400°C to promote absorption of Si into said Al_3Ti layer". Applicants respectfully submit that the prior art as relied upon by the Examiner does not make obvious these features.

Applicants firstly respectfully submit that the Wang reference as relied upon by the Examiner does not sputter deposit an Al_3Ti layer. Particularly, as described in column 4, lines 16-19 of the Wang reference with respect to step 106 in Fig. 3, a **Ti glue layer 60** is deposited. As subsequently described in column 4, lines 34-40 of the Wang reference, "The Ti glue layer 60 is sufficient to react with the Al in the Al/Si/Cu

layer 62 to form $TiAl_3$". Accordingly, it should be readily understood that the Wang reference does not disclose sputter depositing an Al_3Ti layer as featured in claim 10.

On page 3 of the current Office Action dated April 19, 2005, the Examiner acknowledges that the Wang reference does not specifically describe an Al_3Ti target. In other words, the Wang reference does not sputter deposit an Al_3Ti layer. In order to overcome this acknowledged deficiency of the Wang reference, the Examiner has asserted that the Soichi reference describes using an Al_3Ti target. The Examiner has further alleged that it would have been obvious "to include Soichi's Al_3Ti target in Wang's method **to improve the reliability of the membrane (thin film) formed that can be used in optical media devices**" (our emphasis added). Applicants respectfully disagree for the following reasons.

As emphasized above, the $TiAl_3$ layer in the Wang reference is formed by reaction of Ti glue layer 60 with Al in the Al/Si/Cu layer 62. Assuming arguendo that the Soichi reference discloses the use of an Al_3Ti target as asserted by the Examiner, the Examiner has failed to establish the necessary motivation to modify the Wang process as specified in column 4, lines 16-20 thereof, to include an Al_3Ti target so as to sputter deposit an Al_3Ti layer. That is, the Wang reference specifically forms the $TiAl_3$ layer by reaction of Ti glue layer 60, and thus does not need an additional sputter deposited Al_3Ti layer.

The Examiner has suggested that the use of the Al_3Ti target of the Soichi reference would "improve the reliability of the membrane (thin film) formed that can be

used in optical media devices". However, the Wang reference describes contact metallization especially for a MOSFET device having sub-micron dimensions, not an optical media device or a liquid crystal TFT used for optical media such as optical discs as in the Soichi reference. One of ordinary skill would not be motivated to apply a teaching from optical media devices such as optical discs as in the Soichi reference, to modify the MOSFET contact metallization process of the Wang reference.

It should be understood that the method of depositing a wiring thin film of claim 10 includes the separate step of "sputter depositing an Al_3Ti layer on said Ti layer using said Al_3Ti target". This Al_3Ti layer as sputter deposited provides for effective absorption of Si. In contrast, the Wang reference uses Ti glue layer 60 to subsequently form the $TiAl_3$ layer. However, the Soichi reference as generally relied upon by the Examiner to modify the Wang reference discloses the use of Al_3Ti targets in optical media devices, and does not disclose the use of Al_3Ti targets to provide an Al_3Ti layer that effectively absorbs Si. Applicants therefore respectfully submit that the method of depositing a wiring thin film over a semiconductor substrate of claim 10 would not have been obvious in view of the prior art as relied upon by the Examiner taken singularly or together, and that this rejection of claims 10-13 is improper for at least these reasons.

With further regard to this rejection of claim 10, the Examiner has asserted on page 3, lines 17-19 of the current Office Action dated April 19, 2005, "after the sputter depositing, annealing said substrate at a temperature of at least 400°C to promote absorption of Si into said Al_3Ti layer. (Wang fig. 3 #108, col. 4 lines 25-26, col. 3 lines 5-

6)". **However, these specific portions of the Wang reference as relied upon by the Examiner do not disclose annealing**.

Particularly, step 108 in Fig. 3 of the Wang reference features "Al/Si/Cu DEPOSITION at 450°C". Column 4, lines 25-26 of the Wang reference merely describes that the Al/Si/Cu layer 62 is deposited at 450°C by sputtering. Column 3, lines 5-6 of the Wang reference describes precipitation of silicon nodules, and states that "This is due to the high solubility of Si in Al at high temperatures, but low solubility of Si in Al at low temperatures". Contrary to the Examiner's assertion, these particular portions of the Wang reference as specifically relied upon do not disclose annealing.

On page 4 of the current Office Action dated April 19, 2005, the Examiner has further asserted that the Wang reference discloses in column 2, lines 36-37 annealing at 450°C, "but not in the order presently recited in the claims". The Examiner has subsequently asserted that selection of any order of performing process steps is obvious absent new or unexpected results. The Examiner has further asserted that the specification of the present application contains no disclose of the critical nature of the sequence of process steps or any unexpected results therefrom. Applicants respectfully disagree for the following reasons.

The Wang reference describes in column 2, lines 36-37 a conventional process whereby the wafer is annealed at a temperature of about 450°C for about 30 minutes. However, this conventional process as described in the Background of the Invention section of the Wang reference does not include formation or sputter depositing an Al_3Ti

layer. Accordingly, even if the order of the particular conventional process as described in the Background of the Invention section of the Wang reference was rearranged, the above noted annealing as described in column 2, lines 36-37 of the Wang reference **could not possbily occur after sputter depositing of an Al_3Ti layer**. That is, as noted above, the conventional process as described in the Background of the Invention Section of the Wang reference does not disclose sputter depositing an Al_3Ti layer.

Moreover, contrary to the Examiner's assertion, as described on page 7 of the present application, after deposition of Al_3Ti film 53 by a sputter method using an Al_3Ti target, the semiconductor substrate is annealed at a high temperature of at least 400°C in order to promote absorption of Si into the Al_3Ti film. As a result of this annealing, the Al_3Ti film coming into contact with the Al layer absorbs Si in the Al film, which reduces the amount of Si in the Al, and it is thus possible to suppress Si rerystallization growth. In this way, it is possible to prevent formation of an enormous Si deposit.

Accordingly, the specification as noted above indeed discloses the critical nature of the sequence of the process, whereby annealing at a temperature at least 400°C occurs after sputter depositing an Al_3Ti layer, to promote absorption of Si. The prior art as relied upon by the Examiner, particularly the Wang reference, clearly fails to disclose these features or suggest the advantages of these features, because the annealing as described in the Wang reference does not occur subsequent sputter depositing an Al_3Ti layer. Applicants therefore respectfully submit that the method of depositing a wiring thin film over a semiconductor substrate of claim 10 would not have been obvious in

view of the prior art as relied upon by the Examiner taken singularly or together, and that this rejection of claims 10-13 is improper for at least these additional reasons.

The method of forming a wiring film of claim 14 includes in combination "...depositing an Al-Si-Cu layer on said Ti layer"; "pattern etching an Al layer, which forms beneath said Al-Si-Cu layer"; and "after the depositing of the Al-Si-Cu layer, annealing the substrate at a temperature of at least 400°C to form an Al_3Ti layer on said Ti layer". Applicants respectfully submit that the prior art as relied upon by the Examiner does not make obvious these features.

Regarding claim 14, the Examiner has asserted on page 5, lines 7-8 that the Wang reference discloses annealing the substrate at a temperature of at least 400°C, relying on Fig. 3, step 114 and Fig. 2, step 108. However, step 114 in Fig. 3 of the Wang reference features "ETCH OPENINGS FOR VIAS". Step 108 in Fig. 3 of the Wang reference as relied upon by the Examiner features "Al/Si/Cu DEPOSITION AT 450°C". **These particular portions of the Wang reference as specifically relied upon by the Examiner do not disclose annealing as asserted by the Examiner.**

In the rejection of claim 2, the Examiner has relied upon column 2, lines 36-37 of the Wang reference as showing annealing. However, the annealing as described in column 2, lines 36-37 of the conventional process described in the Background of the Invention section of the Wang reference occurs prior to sputtering of the Al-Si-Cu alloy. The annealing as described in column 2, lines 36-37 of the Wang reference does not occur after depositing an Al-Si-Cu layer. Moreover, forming of an Al_3Ti layer is not

described or suggested in connection with the conventional process of the Wang reference.

In contrast, the annealing of claim 14 results in promoting reaction between Al and Ti, to thus form an Al_3Ti alloy layer. As a result, diffusion of Si into the Al_3Ti layer is promoted and the amount of Si in the Al is reduced, making it possible to prevent Si deposits due to recrystallization. The prior art as relied upon by the Examiner does not disclose or suggest these features. Applicants therefore respectfully submit that the method of forming a wiring film of claim 14 would not have been obvious in view of the prior art as relied upon by the Examiner taken singularly or together, and that this rejection of claim 14 is improper for at least these reasons.

The method of forming a wiring film of claim 17 includes in combination "...depositing an Al layer on said Al_3Ti layer"; "pattern etching said Al layer"; and "after the depositing of the Al layer, annealing the substrate at a temperature of at least 400°C". Applicants respectfully submit that the prior art as relied upon by the Examiner does not make obvious these features.

The Examiner has asserted on page 5, lines 12-13 that claim 17 merely repeats the steps of claim 10, and it is therefore rejected for the same reasons as set forth with respect to claim 10. However, as emphasized previously, step 108 in Fig. 3 of the Wang reference; column 4, lines 25-26 of the Wang reference; and column 3, lines 5-6 of the Wang reference do not disclose annealing. Moreover, the annealing as described in column 2, lines 36-37 in the Background of the Invention Section of the

Wang reference occurs prior to sputtering of the Al-Si-Cu alloy. The prior art as relied upon by the Examiner therefore does not disclose annealing the substrate after depositing an Al layer. The prior art does not carry out annealing after deposition of an Al layer in order to promote absorption of Si into an Al_3Ti film so as to suppress Si recrystallization growth. Applicants therefore respectfully submit that the method of forming a wiring film of claim 17 would not have been obvious in view of the prior art as relied upon by the Examiner taken singularly or together, and that this rejection of claims 17, 18 and 20 is improper for at least these reasons.

In the Response to Arguments section at the bottom of page 6 of the current Office Action dated April 19, 2005, the Examiner has asserted that table 2 no. 2 of the Soichi reference (as reproduced on page 7 of the Office Action) is in the English language. However, contrary to the Examiner's assertion, table 2 of the Soichi reference as reproduced on page 7 of the current Office Action is not in the English language.

Conclusion

The Examiner is respectfully requested to reconsider and withdraw the corresponding rejection, and to pass the claims of the present application to issue, for at least the above reasons.

In the event that there are any outstanding matters remaining in the present application, please contact Andrew J. Telesz, Jr. (Reg. No. 33,581) at (571) 283-0720

in the Washington, D.C. area, to discuss these matters.

Pursuant to the provisions of 37 C.F.R. 1.17 and 1.136(a), the Applicants hereby petition for an extension of one (1) month to August 19, 2005, for the period in which to file a response to the outstanding Office Action. The required fee of $120.00 should be charged to Deposit Account No. 50-0238.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment for any additional fees that may be required, or credit any overpayment, to Deposit Account No. 50-0238.

Respectfully submitted,

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